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Fifty Years of Science

How the Unknown has Become a Commonplace

By SIR OLIVER LODGE

LOOKING back at the condition of the scientific world fifty years ago (a thing which, unfortunately, I can very easily do, as my first scientific papers were published a year or two before that date), we cannot but be struck with the immense advances which have been made during the intervening period. At that time the telephone was not imagined even as a possibility. Heavier-than-air flying machines and automobiles were impossible, for the internal-combustion engine, on which they depend, was itself only starting on its career. Vacuum-tube phenomena were in their infancy.

Sir Oliver Lodge
From a new photograph

bustion engine, on which they depend, was itself only starting on its career. Vacuum-tube phenomena were in their infancy.

Even cathode rays had not been discovered. X-rays and radio activity had still to wait twenty years before they were brought to light. Neither radium nor any other self-exploding atom was suspected; and the constitution of electricity was quite unknown. Clerk Maxwell had indeed promulgated his electromagnetic theory of light, and had aroused keen enthusiasm about the mysterious velocity with which the ether transmitted all waves.



But no means of producing such waves was known other than the long-established and blindfold method of making a substance white hot. Somehow it was clear that atoms did radiate energy into the ether, but no one knew how they did it. Spectrum analysis was used by chemists for analysing material and discovering new elements. Crookes had thereby discovered thallium, and thus paved the way for a number of new elements. Helium was only known from a certain line in the solar spectrum, and we were completely in the dark about the laws regulating the series of spectral lines. Larmor and Fitzgerald and Poincaré

were at work, but had not then made their great advances. The names of J. J. Thomson and Hertz had not risen above the scientific horizon; and the majority of present-day workers were either in their infancy or had not been born. Matter was known to be discontinuous; but otherwise continuity reigned supreme. Whatever electricity was, it seemed a continuous entity closely allied with the ether; and the fact that there was a discontinuity in electricity itself, and that it was composed of small particles, almost infinitesimal in size compared with the atoms of matter, would have seemed an absurdity. The laws regulating the interactions of ether and matter are not fully known now, but then they were not even suspected.



Attempts were even then being made, however, to generate ether waves analogous to those of light, though of greater wave-length; but there was no known means of detecting them, even if, as occasionally happened, they were accidentally produced. Ten years had to elapse before Hertz began those famous researches which have now blossomed into radio-telegraphy.

The dominant names in science were Stokes, Maxwell, Kelvin, Helmholtz; and Newtonian dynamics reigned supreme. The velocity of light was known to be an important constant, and had been determined with some accuracy; but no one suspected how important and universal and dominating that velocity was. Perhaps not everyone realizes it even now; though the Theory of Relativity has opened our eyes to this and many other strange possibilities.

What a wild notion it would have seemed if anyone had suggested that matter was built up of electricity; in other words, that it was the manifestation of permanent electric fields in the ether, each centred round a nucleus; furthermore, that this nucleus was the determining entity in chemical atomic weights, and varied by definite integers from one chemical substance to another; that the atom had any analogy with the Solar System; and that radiation was due to the sudden jump of an electric particle from one possible position to another! Atoms then seemed hard, indivisible, permanent, and eternal units, without parts and almost without magnitude,

something like Euclid's points; though, indeed, already the size of atoms was beginning to be calculated. But no one imagined that an atom could be broken up, either spontaneously or by artificial means; and the idea that one element could be changed into another seemed like a baseless mediæval superstition.

Yet all these things have happened, and are becoming commonplaces of physical science; they constitute the foundation on which present-day workers are erecting a still more astonishing structure. For though so much has been accomplished, there is still much more to be done. Many things are known which are not really understood. A novel discontinuity, the quantum, has been unearthed, and its meaning still has to be deciphered.

Meanwhile, electric waves, which fifty years ago were utterly unknown, are now becoming as much a matter of everyday life as the telephone. By their aid conversation can be held with the Antipodes; and the human race is being welded together in a friendly manner, with something like the annihilation of time and space, and with consequences which, though they cannot be foreseen, must ultimately tend towards world-wide peace and international co-operation.

It is inevitable for a physicist to touch upon the advances in Chemistry and Physics, however superficially he skates over the depths beneath; but in all the departments of Biology there have been advances likewise, about which others are more competent to speak. We all know that fifty years ago there was one of the spasmodic controversies between what are somewhat casually called Religion and Science. That things were brought about by a gradual method of evolution, and not by a sudden and so to speak magical transformation, was an



Stella Benson
The author of "Good-bye, Stranger"
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idea resented by many good people, the descendants of whom are not even yet extinct. That every psychic occurrence must have a physical concomitant seemed a doubtful proposition. While the converse thesis, that every physical activity may have a psychic aspect, is not admitted even now. The relation between ether and matter is being worked at; but an examination of the relation between the psychic and the physical has hardly begun.

There seems to be always a region in which controversy rages. The old controversies become worn out, generally by a perception that there was reason on both sides, and certainly by a recognition that there was an overlooked truth in the new views that were being advocated; though when properly understood it might turn out that the new truth was by no means inconsistent with the old.

There is a still persisting controversy among biologists as to the precise method of the evolution of species; and there is a deep-seated controversy between what we may call roughly the religious or spiritual aspect of things and the material or physical aspect. But the controversy has already lost some of its virulence, for more and more are beginning to perceive that there is a unity running through the universe, and that different sides are attending to different aspects of one and the same thing. It is ever likely that a grasp of the whole truth, about even the smallest thing, will be beyond us. We have to divide in order to investigate; and sometimes diversities make more impression upon us than do the occasional glimpses of a fundamental unity—the realization of which is still far ahead.

Meanwhile, it is to be hoped that the supporters of both, or indeed all, sides of the controversy will find themselves able to work in amity; not trying to interfere with each other's efforts, but realizing that, after all, our different views do not affect the real nature of things, that the universe pursues its calm and steadfast way no matter what we think about it, and that we can always take refuge in the fundamental faith of science that, if we each pursue our own branch of science devotedly and with a single mind, Truth will ultimately prevail, and will turn out in the long run to be more gorgeous than anything we could have anticipated.

THE HUMAN ADVENTURE

NOWADAYS we talk much of the human adventure. This is a hopeful sign. Education whether for young or old, except that directed to some special art or profession, should shed light on the nature of our pilgrimage. It is no longer what Bunyan had in mind. Christian, when questioned by Mr. Pliable in regard to the ultimate rewards of the journey, had to admit that it was easier to imagine than describe the bliss of the Celestial City, but that at any rate they would enjoy an unobstructed view of the cherubim and seraphim and of the four and twenty elders. The prospect was too vague and illusive to make much impression on Mr. Pliable. After goshing about for a time in the Slough of Despond he prudently regained the road leading back to the City of Destruction. There is no record of how Christian felt after a hundred million years of casting down his golden crown upon the glassy sea.

The almost inevitable reduction of our hopes and securities which comes with increasing years is usually called disillusion. But why not call it insight? It might include agreeable as well as disagreeable discoveries. Enlightenment might bring really greater security because less subject to rude impacts and dislocation than the older blind and rigid faiths which ran quite counter to honest experience.

English Poets on the New Year

"It is the Nativity of Our Common Adam"—CHARLES LAMB

THE first day of the New Year is by honoured custom a day of hope and good resolutions. We make up our minds to correct our failings and to realize our ambitions. Many of our moralists have chosen that day to remind us of the sad passage of time, but we gain more, perhaps, from those poets who leave repining to the prosateurs and look only to the future. Sir Arthur Quiller-Couch, in his poem "Upon New Year's Eve," looks forward to the hidden season of sowing and the turning of the earth:

Then, dear my wife, be blithe
To bid the New Year hail
And welcome plough, drill, scythe,
And jolly flail.
We know not what he'll bring,
But this we know to-night—
He doth prepare the Spring
For our delight.

Religious echoes of Christmas sound through the first week of the New Year. Christina Rossetti has written a beautiful poem on the Feast of the Epiphany:

Myrrh, frankincense and gold:
And lo! from wintry fold
Goodwill doth bring
A Lamb, the innocent likeness of this King
Whom stars and seraphs sing.

REJOICE WITH FIELDING

The cheerful and reasonable optimism of Fielding sings in our hearts:

This is a day, in days of yore,
Our fathers never saw before;
This is a day, 'tis one to ten
Our sons will never see again.

The poet cheerfully bets on the subject. Burns looks back humorously on the year that has passed:

. . . In thy small space
What dire events have taken place!
Of what enjoyments thou hast reft us!
In what a pickle thou hast left us!

There is a festive spirit in the lines of Tom Hood which help us to face the unknown future pleasantly:

For hark, the last chime of the dial has ceased
And Old Time, who, his leisure to cozen,
Has finished the Months like the flasks at a feast,
Is preparing to tap a fresh dozen!

As Dickens says, "next to Christmas, the most pleasant annual epoch in existence is the advent of the New Year."

The coming of a new year of our life brings uncomfortable thoughts of the march of time. Lightly Austin Dobson expresses this in his "Paradox of Time":

Time goes, you say? Ah! no.
Alas! Time stays, we go,
Or else, were this not so,
What need to chain the hours,
For Youth were always ours?
Time goes, you say? Ah! no.

There is wistfulness in the lines of William Morris, that "idle singer of an empty day":

Then, when the world is born again
And the sweet year before thee lies,
Shall thy heart think of coming pain,
Or vex itself with memories?

Whittier listens to the mournful echo of bells:

The wave is breaking on the shore,
The echo fading from the chime—
Again the shadow moveth o'er
The dial-plate of time.

THE SEASONAL YEAR

The poetic year does not begin with the calendar, but with the first primroses and the song of birds. Shelley expresses this poetic conception and ignores the almanac in his "Dirge for the Year":

Orphan Hours, the Year is dead.
Come and sigh, come and weep.
Merry Hours, smile instead,
For the Year is but asleep.

The year, to him, only awakens with the sunlit showers of April:

January grey is here,
Like a sexton by her grave.

Later poets have also sung of the seasonal year. Alfred Austin tells us:

When December's tottering head,
Rustled 'mong the deep leaves dead.
When pale January lay
In its cradle day by day,
Dead or living, hard to say.

Frost does not depart with the Old Year. As D. G. Rossetti writes, our gardens are still bare:

And for a rose-flower on the darkling mould
The hungry redbreast gleams. No bloom, no bee.

And at night, as Coventry Patmore has sung:

. . . the frozen rut
Is bound with silver bars;
The snow-drift heaps against the hut,
And night is pierced with stars.

The old rhyme bids us be up and doing:

Who in Janiveer sows oats
Gets gold and groats.

BELLS OF OLD AND NEW

Charles Lamb has expressed in lasting words the true significance of New Year's Day for us:

No one ever regarded the first of January with indifference. It is that from which all date their time, and count upon what is left. It is the nativity of our common Adam. Of all sound of bells (bells the music highest bordering upon heaven), most solemn and touching is the peal which rings out the old year. I never hear it without a gathering-up of my mind to a concentration of all the images that have been diffused over the past twelve months. All I have done or suffered, performed or neglected. I begin to know its worth as when a person dies.

No anthology of the New Year would be complete without the familiar lines of Tennyson, which so admirably express our mingled feelings of regret and hope upon the middle hour as the bells call in the unknown:

Ring out the old, ring in the new,
Ring, happy bells, across the snow;
The year is going, let him go;
Ring out the false ring in the true.

So we greet one another hopefully on the first day of the great adventure of 1927 with "A Happy New Year."